CLAIMS

What is claimed is:

1. A semiconductor device, comprising:

a substrate;

a polymer dielectric over the substrate; and

at least one active device comprising an organic semiconductor material and a passive layer.

2. The semiconductor device of claim 1, wherein the polymer dielectric comprises at least one selected from the group consisting of polyimides, fluorinated polyimides, polysilsequioxanes such as hydrogen polysilsequioxanes, methyl polysilsequioxanes, butyl polysilsequioxanes, and phenyl polysilsequioxanes, benzocyclobutenes (BCB), fluorinated benzocyclobutene, polyphenylene, polysilazanes, polyphenylquinoxaline, copolymers of 2,2-bistrifluoromethyl-4,5-difluoro-1,3-dioxole, perfluoroalkoxy resin, fluorinated ethylene propylene, fluoromethacrylate, poly(arylene ether), fuorinated poly(arylene ether), fluorinated parylenes, poly(p-xylxylenes), fluorinated poly(p-xylxylenes), parylene F, parylene N, parylene C, parylene D, amorphous polytetrafluoroethylene, polyquinoline, polyphenylquinoxalines, and polymeric photoresist materials.

3. The semiconductor device of claim 1, wherein the polymer dielectric comprises a self patternable material.

4. The semiconductor device of claim 1, wherein the polymer dielectric has a glass transition temperature or a melting point of about 125° C. or higher and about 425° C. or less.

5. The semiconductor device of claim 1, wherein the polymer dielectric has a dielectric constant below about 3.

6. The semiconductor device of claim 1 further comprising a conductive

polymer.

7. The semiconductor device of claim 1, wherein the organic semiconductor material comprises at least one selected from the group consisting of polyacetylene; polydiphenylacetylene; poly(t-butyl)diphenylacetylene; poly(trifluoromethyl)diphenylacetylene; polybis(trifluoromethyl)acetylene; polybis(t-butyldiphenyl)acetylene; poly(trimethylsilyl) diphenylacetylene; poly(carbazole)diphenylacetylene; polydiacetylene; polyphenylacetylene; polypyridineacetylene; polymethoxyphenylacetylene; polymethylphenylacetylene; poly(t-butyl)phenylacetylene; polynitro-phenylacetylene; poly(trifluoromethyl) phenylacetylene; poly(trimethylsilyl)pheylacetylene; polydipyrrylmethane; polyindoqiunone; polydihydroxyindole; polytrihydroxyindole; furane-polydihydroxyindole; polyindoqiunone-2-carboxyl; polyindoqiunone; polybenzobisthiazole; poly(p-phenylene sulfide); polyaniline; polythiophene; polypyrrole; polysilane; polystyrene; polyfuran; polyindole; polyazulene; polyphenylene; polypyridine; polybipyridine; polyphthalocyanine; polysexithiofene; poly(siliconoxohemiporphyrazine); poly(germaniumoxohemiporphyrazine); poly(ethylenedioxythiophene); polymetallocene complexes; and polypyridine metal complexes.

8. The semiconductor device of claim 1, wherein the passive layer comprises at least one selected from the group consisting of copper sulfide, copper rich copper sulfide, copper oxide, copper selenide, copper telluride, manganese oxide, titanium dioxide, indium oxide, silver sulfide, gold sulfide, iron oxide, cobalt arsenide, and nickel arsenide.

9. The semiconductor device of claim 1, wherein at least one active device comprises a first and a second electrode, a passive layer adjacent the first electrode, and the organic semiconductor material adjacent the second electrode.

10. A semiconductor device, comprising:

a substrate;

a polymer dielectric over the substrate; and

at least one polymer memory device comprising an organic semiconductor material and a passive layer between two electrodes.

11. The semiconductor device of claim 10, wherein the polymer dielectric comprises at least one selected from the group consisting of polyimides, fluorinated polyimides, polysilsequioxanes such as hydrogen polysilsequioxanes, methyl polysilsequioxanes, butyl polysilsequioxanes, and phenyl polysilsequioxanes, benzocyclobutenes (BCB), fluorinated benzocyclobutene, polyphenylene, polysilazanes, polyphenylquinoxaline, copolymers of 2,2-bistrifluoromethyl-4,5-difluoro-1,3-dioxole, perfluoroalkoxy resin, fluorinated ethylene propylene, fluoromethacrylate, poly(arylene ether), fuorinated poly(arylene ether), fluorinated parylenes, poly(p-xylxylenes), fluorinated poly(p-xylxylenes), parylene F, parylene N, parylene C, parylene D, amorphous polytetrafluoroethylene, polyquinoline, polyphenylquinoxalines, and polymeric photoresist materials.

12. The semiconductor device of claim 10, wherein the polymer dielectric has a glass transition temperature or a melting point of about 135° C. or higher and about 400° C. or less.

13. The semiconductor device of claim 10, wherein the polymer dielectric has a dielectric constant below about 2.4.

14. The semiconductor device of claim 10, wherein the polymer dielectric is formed by one of spin-on techniques and chemical vapor deposition techniques.

15. The semiconductor device of claim 10, wherein the organic semiconductor material comprises at least one selected from the group consisting of polyacetylene; polydiphenylacetylene; poly(t-butyl)diphenylacetylene; poly(trifluoromethyl)diphenylacetylene; polybis(trifluoromethyl)acetylene; polybis(t-

butyldiphenyl)acetylene; poly(trimethylsilyl) diphenylacetylene; poly(carbazole)diphenylacetylene; polydiacetylene; polyphenylacetylene; polypyridineacetylene; polymethoxyphenylacetylene; polymethylphenylacetylene; poly(t-butyl)phenylacetylene; polynitro-phenylacetylene; poly(trifluoromethyl) phenylacetylene; poly(trimethylsilyl)pheylacetylene; polydipyrrylmethane; polyindoqiunone; polydihydroxyindole; polytrihydroxyindole; furane-polydihydroxyindole; polyindoqiunone-2-carboxyl; polyindoqiunone; polybenzobisthiazole; poly(p-phenylene sulfide); polyaniline; polythiophene; polypyrrole; polysilane; polystyrene; polyfuran; polyindole; polyazulene; polyphenylene; polypyridine; polybipyridine; polyphthalocyanine; polysexithiofene; poly(siliconoxohemiporphyrazine); poly(germaniumoxohemiporphyrazine); poly(ethylenedioxythiophene); polymetallocene complexes; and polypyridine metal complexes.

16. The semiconductor device of claim 10, wherein the passive layer comprises at least one selected from the group consisting of copper sulfide, copper rich copper sulfide, copper oxide, copper selenide, copper telluride, manganese oxide, titanium dioxide, indium oxide, silver sulfide, gold sulfide, iron oxide, cobalt arsenide, and nickel arsenide.

17. A semiconductor device, comprising:

a substrate;

a polymer dielectric over the substrate;

at least one active device comprising an organic semiconductor material and a passive layer; and

a conductive polymer adjacent at least one active device.

18. The semiconductor device of claim 17, wherein the polymer dielectric has a glass transition temperature or a melting point of about 125° C. or higher and about 425° C. or less and a dielectric constant below about 3.

19. The semiconductor device of claim 17, wherein the polymer dielectric comprises at least one selected from the group consisting of polyimides, fluorinated polyimides, polysilsequioxanes such as hydrogen polysilsequioxanes, methyl polysilsequioxanes, butyl polysilsequioxanes, and phenyl polysilsequioxanes, benzocyclobutenes (BCB), fluorinated benzocyclobutene, polyphenylene, polysilazanes, polyphenylquinoxaline, copolymers of 2,2-bistrifluoromethyl-4,5-difluoro-1,3-dioxole, perfluoroalkoxy resin, fluorinated ethylene propylene, fluoromethacrylate, poly(arylene ether), fuorinated poly(arylene ether), fluorinated parylenes, poly(p-xylxylenes), fluorinated poly(p-xylxylenes), parylene F, parylene N, parylene C, parylene D, amorphous polytetrafluoroethylene, polyquinoline, polyphenylquinoxalines, and polymeric photoresist materials.

20. The semiconductor device of claim 17, wherein the active device comprises a polymer memory device comprising the organic semiconductor material and the passive layer between two electrodes, the organic semiconductor material comprising a conjugated polymer.